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Education

B. Sc., University of Texas at Austin, May 1981.
PhD., University of California at Berkeley, 1987, Dissertation: Inversion of Static Displacement of the Earth's Surface.

Professional Experience

1986-1987 Associate Research Scientist, Berkeley Laboratory
1987-1989 Post-Doctoral Scientist, Phillips Geophysics Laboratory
1989-1991 Post-Doctoral Scientist, Seismographic Station, University of California at Berkeley.
1991-1992 Visiting Fellow, Research School of Earth Sciences, Australian National University.
1992-Present Staff Scientist, Berkeley Laboratory

Current Research Interests and Experience

Geophysical inversion and non-linear inverse problems; Seismic tomographic imaging; Use of geodetic observations to constrain subsurface fluid flow; Waveform inversion; Analysis and modeling of hydrological pressure, tracer, and multi-phase flow data; Combined inversion of geophysical and hydrological data;

Current Grants and Funding

Research consortium, 'Model Calibration and Efficient Reservoir Imaging', with Professor Akhil Datta-Gupta (225K/year, multiple years)

DOE Basic Energy Sciences grant 'Imaging Permeability and Fluid Mobility in a deformable medium' (225K/year, 3 years).

Fellowships

University of California Graduate Opportunity Fellowship 1981-1982

Awards

Cedric K. Ferguson Certificate, for the best peer reviewed paper published by an SPE journal in 1999.

Member

American Geophysical Union;
Society of Exploration Geophysicists;

Publications

Journal Articles

Vasco, D.W. and L.R. Johnson, 1985. Extremal inversion of static earth displacements due to volume sources, *Geophys. J. R. astr. Soc.*, **80**, 223-239.

Vasco, D. W., 1985. Extremal inversion of vertical displacements, Long Valley caldera 1982/1983, *J. of Geophysics*, **57**, 178-183.

Vasco, D. W., 1986. Extremal inversion of travel time residuals, *Bull. Seis. Soc. Am.*, **76**, 1323-1345.

Vasco, D. W. and L. R. Johnson, 1986. The correspondence between gravitational attraction and surface displacement due to volume expansion, *Geophys. J. of the Royal astr. Soc.*, **89**, 749-754.

Vasco, D. W., L. R. Johnson, and N. E. Goldstein, 1988. Using surface displacement and strain observations to constrain deformation at depth, with an application to Long Valley caldera, CA, *J. of Geophys. Res.*, **93**, 3232-3242.

Vasco, D. W., L. R. Johnson, 1989. Inversion of waveforms for extreme source models with an application to the isotropic moment tensor component, *Geophys. J. Royal astr. Soc.*, **97**, 1-18.

- Vasco, D. W., 1989. Deriving source-time functions using principal component analysis, *Bull. Seis. Soc. Am.*, **79**, 711-730.
- Vasco, D. W., 1989. Resolution and variance operators of gravity and gravity gradiometry, *Geophysics*, **54**, 889-899.
- Vasco, D. W., 1990. Moment tensor invariants: Searching for non-double-couple earthquakes, *Bull. Seis. Soc. Am.*, **80**, 354-371.
- Vasco, D. W., 1990. Seismic source representation in orthogonal functions, *Geophys. Jour. Int.*, **102**, 531-535.
- Vasco, D. W., Smith, R. B., and Taylor, C. L., 1990. Inversion for sources of crustal deformation and gravity change at the Yellowstone Caldera, *J. Geophys. Res.*, **95**, 19,839-19,856.
- Vasco, D. W. and Taylor, C., 1991. Inversion of airborne gravity gradient data, Southwestern, Oklahoma, *Geophysics*, **56**, 90-101.
- Vasco, D. W., 1991. Bounding seismic velocities using a tomographic method, *Geophysics*, **56**, 472-482.
- Pulliam, R. J., Vasco, D. W., and Johnson, L. R., 1993. Tomographic inversions for mantle P-wave velocity structure based on the minimization of l2 and l1 norms of International Seismological Centre travel time residuals, *J. Geophys. Res.*, **98**, 699-734.
- Vasco, D. W., 1993. Degeneracy, singularity, and multiple solutions in geophysical inversion, *Geophys. Jour. Int.*, **113**, 434-448.
- Vasco, D. W., Pulliam, R. J., and Johnson, L. R., 1993. Formal inversion of ISC arrival times for Mantle P-velocity structure, *Geophys. Jour. Int.*, **113**, 586-606.
- Vasco, D. W., Majer, E. L., and Johnson, L. R., 1993. Ensemble inference in geophysical inverse problems, *Geophy. Jour. Int.*, **115**, 711-728.
- Vasco, D. W., and Majer, E. L, 1993. Wave-path travelttime tomography, *Geophy. Jour. Int.*, **115**, 1055-1069.

Vasco, D. W., Pulliam, R. J., Earle, P. S., and Johnson, L. R., 1994. Robust inversion of ISC arrival times for Mantle P and S wave velocity structure, earthquake mislocation, and station corrections, *J. Geophys. Res.*, **99**, 13727-13755.

Vasco, D. W., 1994. Singularity and branching: A path following formalism for geophysical inverse problems, *Geophys. Jour. Int.*, **119**, 809-830.

Vasco, D. W., 1995. A transformational approach to geophysical inverse problems, *Geophys. Jour. Int.*, **123**, 183-212.

Vasco, D. W., Pulliam, R. J., and Johnson, L. R., 1995. Lateral variations in mantle velocity structure and discontinuities determined from P, PP, S, SS, and SS-SdS traveltimes residuals, *J. Geophys. Res.*, **100**, 24,037-24,059.

Vasco, D. W., Majer, E. L., and Peterson, J. E., 1995. Beyond ray tomography: Wavepaths and Fresnel volumes, *Geophysics*, **60**, 1790-1804.

Romero, A. E., McEvilly, T. V., Majer, E. L., and Vasco, D. W., 1995. Characterization of the geothermal system beneath the Northwest Geysers steam field, California, from seismicity and velocity patterns, *Geothermics*, **24**, 471-487.

Datta Gupta, A., Vasco, D. W., and Long, J. C. S., 1995. Detailed characterization of a fractured limestone formation using stochastic inverse approaches, *SPE Form. Eval.*, September, 133-140.

Vasco, D. W., Peterson, J. E., Jr., and Majer, E. L., 1996. Nonuniqueness in traveltimes tomography: Ensemble inference and cluster analysis, *Geophysics*, **61**, 1209-1227.

Vasco, D. W., Peterson, J. E., and Majer, E. L., 1996. A simultaneous inversion of seismic traveltimes and amplitudes for velocity and attenuation, *Geophysics*, **61**, 1738-1757.

Majer, E. L., Datta-Gupta, A., Peterson, J. E., Vasco, D. W., Myer, L. R., Daley, T. M., Kalen, B., Queen, J., D'Onfro, P. S., Rizer, W. D., Cox, D., and Sinton, J., 1996. Utilizing crosswell, single well and pressure

transient test for characterizing fractured gas reservoirs, *The Leading Edge*, **15**, 951-956.

Vasco, D. W., Datta-Gupta, A., and Long, J. C. S., 1997. Resolution and uncertainty in hydrologic characterization, *Water Resour. Res.*, **33**, 379-397.

Vasco, D. W., 1997. Groups, algebras and the nonlinearity of geophysical inverse problems, *Geophys. J. Int.*, **131**, 9-23.

Vasco, D. W., Peterson, J. E., and Lee, K., 1997. Ground penetrating radar velocity tomography in inhomogeneous and anisotropic media, *Geophysics*, **62**, 1758-1773.

Vasco, D. W., and Datta-Gupta, A., 1997. Integrating field production history in stochastic reservoir characterization, *SPE Form. Eval.*, September, 149-156.

Datta-Gupta, A., Vasco, D. W., and Long, J. C. S., 1997. On the sensitivity and spatial resolution of transient pressure and tracer data for heterogeneity characterization, *SPE Form. Eval.*, June, 137-144.

Long, J. C. S., Doughty, C., Datta-Gupta, A., Hestir, K., and Vasco, D., 1997. Component characterization: An approach to fracture hydrology, in *Subsurface Flow and Transport: A stochastic Approach*, Dagan, G., and Neuman, S. P. (Eds.), Cambridge University Press.

Vasco, D. W., Karasaki, K., and Myer, L., 1998. Inversion of surface tilt caused by fluid migration, *J. of Geotech. and Geoenv. Eng.*, **124**, 29-37 .

Vasco, D. W., and Johnson, L. R., 1998. Whole Earth structure estimated from seismic arrival times, *J. Geophys. Res.*, **103**, 2633-2671.

Vasco, D. W., Peterson, J. E., and Majer, E. L., 1998. Resolving seismic anisotropy: Sparse matrix methods for geophysical inverse problems, *Geophysics*, **63**, 970-983.

Vasco, D. W., 1998. Regularization and trade-off associated with non-linear geophysical inverse problems, *Inverse Problems*, **18**, 1033-1052.

D'Onfro, P. S., Rizer, W. D., Queen, J. H., Majer, E. L., Peterson, J. E., Daley, T. M., Vasco, D. W., Datta-Gupta, A., and Long, J. C. S., 1998. An integrated approach for characterizing fractured reservoirs, in *Faulting, Fault Sealing, and Fluid Flow in Hydrocarbon Reservoirs*, Jones, G., Fisher, Q., and Knipe, R. J. (Eds), 193-208.

Datta-Gupta, A., Yoon, S., Barman, I., and Vasco, D. W., 1998. Streamline-based production data integration, *J. of Petrol. Tech.*, December, 72-76.

Vasco, D. W., and Datta-Gupta, A., 1999. Asymptotic solutions for solute transport: A formalism for tracer tomography, *Water Resour. Res.*, **35**, 1-16.

Vasco, D. W., Johnson, L. R., and Marques, O., 1999. Global Earth structure: Inference and assessment, *Geophys. J. Int.* **137**, 381-407.

Vasco, D. W., 1999. Intersections, ideals, and inversion, *Inverse Problems*, **15**, 1573-1602.

Vasco, D. W., Yoon, S., and Datta-Gupta, A., 1999. Integrating dynamic data into high-resolution reservoir models using streamline-based analytic sensitivity coefficients, *Soc. Petr. Eng. Journal*, **4**, (4) .

Vasco, D. W., Karasaki, K., and Doughty, C., 2000. Using surface deformation to image reservoir dynamics, *Geophysics*, **65**, 132-147.

Keers, H., Johnson, L., R., and Vasco, D. W., 2000. Acoustic crosswell imaging using asymptotic waveforms, *Geophysics*, **65**, 1569-1582.

Vasco, D. W., 2000. An algebraic formulation of geophysical inverse problems, *Geophys. J. Int.* **142**, 970-990.

Karasaki, K., Freifeld, B., Cohen, A., Grossenbacher, K., Cook, P., and Vasco, D., 2000. A Multidisciplinary Fractured Rock Characterization Study at Raymond Field Site, Raymond, California, *J. of Hydrology*, **236**, 17-34.

Vasco, D. W., Karasaki, K., and Keers, H., 2000. Estimation of reservoir properties using transient pressure data: An asymptotic approach, *Water*

Resour. Res., **36**, 3447-3465.

Vasco, D. W., and Datta-Gupta, A., 2001. Asymptotics, saturation fronts, and high resolution reservoir characterization, *Transport in Porous Media*, **42**, 315-350.

Datta-Gupta, A., and Vasco, D. W., 2001. Production tomography merges geophysics with reservoir engineering, *Oil and Gas Journal*, **June 4**, 75-81.

Keers, H., Vasco, D. W., and Johnson, L. R., 2001. Viscoacoustic cross-well imaging using asymptotic waveforms, *Geophysics*, **66**, 861-870.

Datta-Gupta, A., Nordaas, K., Yoon, S., and Vasco, D. W., 2001. Streamlines, ray tracing, and production tomography: Generalization to compressible flow, *Petroleum Geoscience*, **7**, S75-S86.

Yoon, S., Malallah, A. H., Datta-Gupta, A., Vasco, D. W., and Behrens, R. A., 2001. A multiscale approach to production data integration using streamline models, *Soc. Petr. Eng. Journal*, June, 182-192.

Vasco, D. W., and Karasaki, K., 2001. Inversion of pressure observations: An integral formulation, *J. of Hydrology*, **253**, 27-40.

Kulkarni, K. N., Datta-Gupta, A. and Vasco, D. W., 2001. A Streamline Approach to Integrating Transient Pressure Data into High Resolution Reservoir Models, *Soc. Petr. Eng. Journal*, **6**.

Vasco, D. W., and Datta-Gupta, A., 2001. Asymptotics, streamlines, and reservoir modeling: A pathway to production tomography, *The Leading Edge*, **20**, 1164-1171.

Vasco, D. W., Karasaki, K. and Kishida, K., 2001. A coupled inversion of pressure and surface displacement, *Water Resour. Res.*, **37**, 3071-3089.

Vasco, D. W., Wicks, C., and Karasaki, K., 2002. Geodetic imaging: High resolution reservoir monitoring using satellite interferometry, *Geophys. J. Int.*, **149**, 555-571.

Vasco, D. W., Karasaki, K. and Nakagome, O., 2002. Monitoring reservoir production using surface deformation at the Hijiori test site and the Okuizu geothermal field, Japan, *Geothermics*, **31**, 303-342.

Datta-Gupta, A., Yoon, S., Vasco, D. W., and Pope, G. A., 2002. Inverse modeling of partitioning interwell tracer tests: A streamline approach, *Water Resour. Res.*, **38** (6), 10.1029.

Iliassov, P. A., Datta-Gupta, A., and Vasco, D. W., 2002. Field-scale characterization of permeability and saturation distributions using partitioning tracer tests: The Ranger Field, Texas, *SPE J.*, **7** (4), 409-423, December.

Vasco, D. W., Johnson, L. R., and Marques, O., 2003. Resolution, uncertainty, and whole Earth tomography, *J. Geophys. Res.*, **108** (B1), 2022.

Vasco, D. W., Keers, H., Peterson, J., and Majer, E. L., 2003. Zeroth order asymptotics: Waveform inversion of the lowest degree, *Geophysics*, **68**, 614-628.

Vasco, D. W., and Finsterle, S., 2004. Numerical trajectory calculations for the efficient inversion of flow and tracer observations, *Water Resour. Res.*, **40**, (1) 10.1029.

Vasco, D. W., 2004. Seismic imaging of reservoir flow properties: Time-lapse pressure changes, *Geophysics*, **69**, (2), 511-521.

Vasco, D. W., Datta-Gupta, A., Behrens, R., Condon, P., and Rickett, J., 2004. Seismic imaging of reservoir flow properties: Time-lapse amplitude changes, *Geophysics*, **69**, 6, 1425-1442.

Vasco, D. W., 2004. Estimation of flow properties using surface deformation and head data: A trajectory-based approach, *Water Resources Research*, **40**, W10104, 1-14.

Vasco, D. W., 2004. An asymptotic solution for two-phase flow in the presence of capillary forces, *Water Resour. Res.*, **40**, W12407, 1-13.

Vasco, D. W., and Ferretti, A., 2005. On the use of quasi-static deformation to understand reservoir fluid flow, *Geophysics*, **70**, O13-O27.

He, Z., Datta-Gupta, A., Al-Harbi, M., and Vasco, D. W., 2006. Rapid inverse modeling of pressure interference tests using trajectory-based travel time and amplitude matching, *Water Resources Research*, bf 42, W03419, 1-15.

Hoversten, G. M., Cassasuce, F., Gasperikova, E., Newman, G. A., Chen, J., Rubin, Y., Hou, Z., and Vasco, D., 2006. Direct reservoir parameter estimation using joint inversion of seismic AVA and marine CSEM data, *Geophysics*, **71**, C1-C13.

Amodei, D., Keers, H., Vasco, D., and Johnson, L., 2006. Computation of uniform wave forms using complex rays, *Physical Review E*, **73**, 36704/1-14.

Vasco, D. W., and Karasaki, K., 2006. Interpretation and inversion of low-frequency head observations, *Water Resources Research*, **42**, W05408/1-18.

Battaglia, M., and Vasco, D. W., 2006. The search for magma reservoirs in Long Valley Caldera: Single versus distributed sources, in *Mechanisms of Activity and Unrest at Large Calderas*, Troise, C., De Natale, G. and Kilburn, C. R. J. (eds) Geological Society of London Publication **269**, 173-180.

Hou, Z., Rubin, Y., Hoversten, M., Vasco, D., and Chen, J., 2006. Reservoir-parameter identification using minimum relative entropy-based Bayesian inversion of seismic AVA and CSEM data, *Geophysics*, **71**, O77-O88.

Chen, J., Hoversten, M., Vasco, D., Rubin, Y., and Hou, Z., 2007. A Bayesian model for gas saturation estimation using marine seismic AVA and marine CSEM data, *Geophysics*, **72**, WA85-WA95.

Vasco, D. W., 2007. Invariance, groups, and non-uniqueness: The discrete case, *Geophysical Journal International*, **168**, 473-490.

Vasco, D. W., 2007. Trajectory-based modeling of broadband electromagnetic wavefields, *Geophysical Journal International*, **168**, 949-963.

Keers, H., Johnson, L., and Vasco, D. W., 2007. Determination of poros-

ity and saturation using seismic waveform inversion, *Studia Geophysica and Geodetica*, **51**, 119-140.

Vasco, D. W., Puskas, C. M., Smith, R. B., and Meertens, C. M., 2007. Crustal deformation and source models of the Yellowstone volcanic field from geodetic data, *J. of Geophysical Res.*, **112**, doi:10.1029/2006JB004641.

Vasco, D. W., 2008. Trajectory-based methods for modeling and characterization, in *Quantitative Information Fusion for Hydrological Sciences*, Xing, C., and Yeh, T. -C. J. (eds) Springer-Verlag, Studies in Computational Intelligence, 69-103.

Vasco, D. W., 2008. Zeroth-order inversion of transient head observations, *Inverse Problems*, **24**, 025013.

Vasco, D. W., 2008. Modeling quasi-static poroelastic propagation using an asymptotic approach, *Geophysical Journal International*, **173**, 1119-1135.

Vasco, D. W., Keers, H., Khazanehdari, J., and Cooke, A., 2008. Seismic imaging of reservoir flow properties: Resolving water influx and reservoir permeability, *Geophysics*, **73**, O1-O13.

Vasco, D. W., Ferretti, A., and Novali, F., 2008. Estimating permeability from quasi-static deformation: Temporal variations and arrival time inversion, *Geophysics*, **73**, O37-O52.

Vasco, D. W., Ferretti, A., and Novali, F., 2008. Reservoir monitoring and characterization using satellite geodetic data: Interferometric Synthetic Aperture Radar observations from the Krechba field, Algeria, *Geophysics*, **73**, WA113-WA122.

Vasco, D. W., 2009. Modeling broadband poroelastic propagation using an asymptotic approach, *Geophysical Journal International*, **179**, 299-318.

Vasco, D. W., and Minkoff, S. E., 2009. Modeling flow in a pressure-sensitive, heterogeneous medium, *Geophysical Journal International*, **179**, 972-989.

Vasco, D. W., Rucci, A., Ferretti, A., Novali, F., Bissell, R., Ringrose, P.,

Mathieson, A., and Wright I., 2010. Satellite-based measurements of surface deformation reveal flow associated with the geological storage of carbon dioxide, *Geophysical Research Letters*, **37**, doi:10.1029/2009GL041544, 1-5.

Rutqvist, J., Vasco, D. W., and Myer, L., 2010. Coupled reservoir-geomechanical analysis of CO₂ injection and ground deformations at In Salah, Algeria, *International Journal of Greenhouse Gas Control*, (in press).

Vasco, D. W., 2010. Modeling flow when the fluid density depends upon the pressure, *Water Resources Research*, (in press).

Rucci, A., Vasco, D. W., and Novali, F., 2010. Fluid pressure arrival time tomography: Estimation and assessment in the presence of inequality constraints, with an application to production at the Krechba field, Algeria, *Geophysics*, (submitted).

Vasco, D. W., 2010. On the propagation of a disturbance in a heterogeneous, deformable, porous medium saturated with two fluid phases, *Geophysics*, (submitted).

Meeting Abstracts

Presented over 66 abstracts at the American Geophysical Union, the Society of Exploration Geophysicists, and the Seismological Society of America meetings. Invited to present talks at the Fall 1993 American Geophysical Union meeting, the 1994 International Association of Seismology and Physics of the Earth's Interior meeting in Wellington, New Zealand, and the 1994 meeting of the Seismological Society of America in Anaheim, CA.